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CARRIER FREQUENCY VOLTMETER

MODEL 101A

PHILCO

Ford

PHILCO-FORD CORPORATION
Sierra Electronic Operation
Menlo Park, Calif. • 94025

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DESCRIPTION: CARRIER FREQUENCY VOLTMETER	
MANUFACTURE: SIERRA	MODEL: 101A

CALIBRATION REQUIREMENTS

SOURCE: ERS FT. WAYNE	TAR=> N/A	CALIBRATION/TEST INTERVAL:12 MONTHS

APPLICABLE PAGES.

ALL PAGES ARE APPLICABLE.

MISCELLANEOUS NOTES.

DISREGARD ALL HIGHLIGHTED AREAS AND NOTATIONS THAT HAVE NOT BEEN INITIALED AND DATED.

REQUIRED CALIBRATION STICKER.

Calibration:_XX_
Performance Check:_____
Limited Calibration:_____
Other:_____ (see misc. notes)

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STANDARDS LIST

NOTE: The equipment list below reflects the STANDARDS recommended by the calibration procedure of the UUT. Deviations from the recommended STANDARDS will be documented on this sheet.

UUT:

RECOMMENDED STANDARDS	STANDARDS USED

REMARK: Calibration personnel are responsible to verify compliance to QUALITY ASSURANCE and IMPROVEMENT MANUAL QM0001 Paragraph 4.4 Document Number P4040005 Section VI and Paragraph 4.10 before use.

INSTRUCTION MANUAL

CARRIER FREQUENCY VOLTMETER

MODEL 101A

Stock No. 950000111
JAN 17 1966

OPERATING AND MAINTENANCE INSTRUCTIONS

for

MODEL 101A CARRIER FREQUENCY VOLTMETER

GENERAL DESCRIPTION

The Model 101A Carrier Frequency Voltmeter is designed to measure voltages at any frequency in the range from 20 kc to 500 kc.

The instrument is actually a radio receiver with a tuning range from 20 kc to 500 kc. The dc output from the final detector operates an INDICATING METER on the front panel, calibrated to show the values of the voltages appearing at the voltmeter input terminals. A VARIABLE ATTENUATOR, also adjusted from the front panel, is connected between the input terminals and the first grid, serving to increase the range of measurable voltages. The voltmeter operates with fixed gain, and is therefore a voltage measuring device at the frequency to which it is tuned.

The voltmeter is also equipped with an injection oscillator, which is in effect a signal generator, for the purpose of calibrating its sensitivity to input voltages. This oscillator can be switched into operation at will.

A block diagram is included herewith to help the user understand the functions of the voltmeter. As shown, the signal input first passes through a section which includes the variable ATTENUATOR and an input filter, before arriving at the grid of the first detector. The input filter is a band-pass variety with a pass band from 20 kc to 500 kc. Its purpose is to reject all signals outside of this band. The variable ATTENUATOR merely reduces by known amounts the signal arriving at the grid of the first detector, so as to increase the voltage measuring range of the instrument and make possible the measurement of relatively large voltages.

The TUNING DIAL on the front of the voltmeter controls the frequency of a variable frequency oscillator over a range of 1000 kc to 1480 kc. The output of this oscillator combines with the incoming signal in the first detector to produce an intermediate frequency (IF) of 1500 kc. Likewise, the 1500 kc signal, after passing through the IF amplifier, combines in the second detector with the 1582 kc crystal controlled oscillator frequency to produce a second intermediate frequency of 82 kc. The output of the 82 kc amplifier goes directly into the crystal detector, the d-c output of which operates the INDICATING METER.

An injection oscillator, which operates at 100 kc, is included in the voltmeter. This oscillator provides a fixed known amplitude signal which can be switched to the input circuit and substituted for the incoming signal for calibration purposes.

The injection oscillator circuit contains a vacuum tube voltmeter, for monitoring the amplitude of oscillations to insure an accurate injection signal amplitude. The dc output from this vacuum tube voltmeter is also indicated on the INDICATING METER when desired.

A LISTENING JACK is provided on the front panel for the use of a headset, to listen to the incoming signals. The headset is energized from an audio amplifier, the audio level of which is adjustable from the AUDIO level control on the front panel.

The dc voltages used in the voltmeter are regulated in the power supply section. The object of this arrangement is to insure relatively constant voltage in the instrument under conditions where the 115V supply is not constant.

SUPPLY VOLTAGE

Model 101A voltmeter is designed to operate from a main supply of 115 volts, 60 cycles. It will operate satisfactorily in the range from 105 volts to 125 volts. The OFF-ON Power Switch is incorporated in the AUDIO control; turn clockwise for ON position.

FUSE

A fuse for the main supply is located on the rear of the chassis and is available for replacement by unscrewing the block cap marked FUSE. Replacement fuses should be rated at 2 amperes and be of the Bussman 3 AG type.

INDICATING METER

The INDICATING METER on the front panel has a 0-200 microampere range, but the scale is calibrated in decibels. The calibrations indicate in decibels the ratios of voltages at the input terminals to the receiver.

ATTENUATOR

The attenuator steps are in ten decibel intervals. The steps between +40 and +10 are connected ahead of the band-pass filter, those between -60 and +10 follow the filter (see schematic).

OPERATING INSTRUCTIONS

INJECTOR CALIBRATION (Level adjustment using internal source.)

The voltmeter contains an injection oscillator tuned to 100 kc which will deliver 0.77 volts ("0" db) to the input for calibrating purposes when the INJECTOR switch on the front panel is placed in the CAL position. The switch canges the internal circuit from the IN (input) terminal to the injection oscillator output (see block diagram) and at the same time connects the plate voltage to the oscillator.

In order to make certain that the amplitude from the injector oscillator is correctly adjusted, the output (dc) from the diode in the vacuum tube voltmeter may be switched to the INDICATING METER by placing the METER switch in the CAL position. This circuit is adjusted at the factory to indicate "0" db on the meter when operating normal.

To use the injector for calibration:

1. Place the INJECTOR switch in the CAL position (after the voltmeter has been turned on for at least 5 minutes).

2. Place the METER switch in the CAL position. The INDICATING METER should show "0" db.

3. Return the METER switch to the REC position and after setting the ATTENUATOR at "0" db adjust the main Tuning Dial for maximum response on the INDICATING METER at around 100 kc. If the meter reading is not "0" db it should be so adjusted by the RADIO control knob. The sensitivity is now properly adjusted.

4. Return the INJECTOR switch to the REC position and proceed with measurements.

EXTERNAL CALIBRATION (Level adjustment using external source.)

If it is desired to use an external source for calibration, the sensitivity control on the front panel marked RADIO should be adjusted to produce "0" db reading on the INDICATING METER with the attenuator set at "0" db, the tuning dial tuned to incoming signal and with 0.77 volts rms (1 milliwatt into 600 ohms, or "0" db) applied to the input terminals (labelled IN and GND). With this adjustment the voltmeter is

set at normal sensitivity. For general sensitivity checks the frequency used should be about 100 kc. However, for maximum accuracy this adjustment should be made in the region of the frequencies under measurement. Always make certain tuning dial is set for maximum response.

TUNING DIAL

The TUNING DIAL on the front panel reads directly in kilocycles and is adjusted at the factory within ±3 kilocycles in the ambient temperature range of 45°F to 90°F.

Measurements below 18 kc should not be attempted because an error is introduced when the main oscillator frequency approaches that of the 1500 kc IF amplifier. This error is evident by the large INDICATING METER deflection in the region of zero on TUNING DIAL.

INJECTOR HARMONICS

The injection voltage is selected from a portion of the injection Oscillator circuit which is rich in harmonics in order to produce indicating meter deflections when the tuning dial is adjusted to the harmonics of 100 kc or to the 200 kc, 300 kc, 400 kc and 500 kc settings. This feature is provided for a quick check of the tuning dial FREQUENCY CALIBRATION.

CAUTION: Use only the 100 kc dial setting for injector calibration purposes since the harmonic voltage amplitudes are less than the 100 kc amplitude. A special calibration must be provided if injector calibration at harmonic frequencies is desired.

USE OF HEADSET

A headset may be used for listening to the incoming signals, by plugging into the JACK below the INDICATING METER. The audio level is adjustable from the control knob labelled AUDIO. Headset resistance should be 2000 ohms or more, as lower resistance sets will not respond well.

OVERLOADS

The voltmeter is protected for reasonable overloads but caution should be used to avoid large off-scale deflections in the INDICATING METER.

INPUT IMPEDANCE

The input impedance is greater than 10,000 ohms in the rejection band and approximately 10,000 ohms in the pass band between 20 kc and 500 kc.

MAINTENANCE

The Model 101A Carrier Frequency Voltmeter should require no maintenance during normal use except for occasional change of tubes and the removal of dust and dirt. The change of tubes will affect the sensitivity of the instrument and therefore it should be rechecked for sensitivity with either the injection oscillator or an external known source of voltage preferably around 100 kc (see instructions above).

INJECTION OSCILLATOR

If the tube to be changed is in the injection oscillator, the following steps should be followed after insertion of new tube and allowing at least a 5-minute warm-up period:

1. With INJECTOR switch in CAL position and METER switch in CAL position, adjust potentiometer shaft marked "W" (located next to OB-2 tube at rear of chassis) with screwdriver to give "0" db reading on INDICATING METER.

2. Return METER switch to REC position and adjust frequency of injection oscillator to 100 kc by using insulated screwdriver in slot at location marked "H" on injection oscillator assembly on underneath side of chassis. Tuning can be accomplished by direct beating of injection oscillator with external frequency source or by tuning the injection oscillator frequency for maximum deflection of INDICATING METER when TUNING DIAL is set to 100 kc - the latter 100 kc tuning dial point should, for accuracy, be set from an external source (with INJECTOR switch in REC position) to give best frequency accuracy.

3. After frequency of injection oscillator has been set, the indicating Meter should read "0" after the voltmeter sensitivity level has been properly adjusted by the RADIO Control Knob according to procedure given above under EXTERNAL CALIBRATION. If deflection on INDICATING METER is not "0", the level can be set by adjusting potentiometer shaft marked "P" located on rear of chassis next to "W". This resistor is R42 on the schematic.

VARIABLE FREQUENCY OSCILLATOR

In case it is necessary to change the oscillator tube in the variable frequency oscillator (connected to the TUNING DIAL), it may also be necessary to readjust the circuit constants so that the TUNING DIAL numerals will correspond to the correct incoming signal frequencies. This adjustment is accomplished by connecting the voltmeter to an accurate 100 kc signal source, setting the Tuning Dial at 100 kc and adjusting the oscillator inductor for maximum INDICATING METER deflection by inserting screwdriver in hole marked "0" on top side of variable oscillator housing.

DO NOT attempt to make adjustments at opening marked "X" on rear side of Variable Frequency Oscillator housing. This adjustment affects ratio of Inductance to Capacity in oscillator circuit and controls tracking of Tuning Dial. This adjustment, if necessary, should be made at factory or central service point where proper test equipment and instructions are available.

REPLACEABLE PARTS LIST

PARTS REPLACEMENT

Standard components have been used in this instrument whenever possible. Both standard and special components may be ordered direct from the factory.

When ordering parts always include:

1. Sierra Stock Number.
2. Circuit Reference and Commercial Description.
3. Name, Model and Serial Number of the Instrument.

Parts for this instrument, or further service information may be obtained from:

SIERRA ELECTRONIC DIVISION
Philco Corporation
3885 Bohannon Drive
Menlo Park, California 94025

Telephone (415) 322-7222
TWX 910-373-1282

REPLACEABLE PARTS LIST

Schem. Ref. No.	Description	Use	Mfr.	Dwg. or Mfr. No.	Tot. Quan.
BP1	BINDING POST		Millen	37222-37202	
C1	CAPACITOR, 1.5-7 mmfd, Variable		Erie	TS2A-NPO	
C2	CAPACITOR, .01 mfd, Paper, 400VDCW		Sangamo	300411	
C3	CAPACITOR, .1 mfd, Paper, 400VDCW		Sangamo	300401	
C4	Same as C2				
C5	CAPACITOR, Special Variable		Sierra	SU-1040-1	
C6	Same as C2				
C7	Same as C2				
C8	Same as C2				
C9	CAPACITOR, .0001 mfd, Mica ±10% 500WVDC		Sangamo	K-1310	
C10	CAPACITOR, .001 mfd, Mica ±10% 500VDCW		Sangamo	K-1210	
C11	Same as C2				
C12	Same as C2				
C13	Same as C3				
C14	Same as C2				
C15	Same as C2				
C16	Same as C2				
C17	Same as C10				
C18	Same as C2				
C19	CAPACITOR, .00025 mfd, Mica ±10% 500VDCW		Sangamo	K-1325	
C20	Same as C10				
C21	Same as C2				
C22	Same as C2				
C23	Same as C2				
C24	CAPACITOR, .00005 mfd, Mica ±10% 500VDCW		Sangamo	K-1450	
C25	Same as C2				
C26	Same as C2				
C27	Same as C2				
C28	Same as C2				
C29	Same as C10				
C30	Same as C9				
C31	Same as C2				
C32	Same as C2				
C33	CAPACITOR, 140 mmfd, Variable		Bud	LC-2082	
C34	CAPACITOR, 175 mmfd, Ceramicon ±5%		Erie	NPOD175	
C35	CAPACITOR, 100 mmfd, Variable		National	TMSE-100E	
C36	CAPACITOR, 20-20-20 mfd, Dry Electrolytic, with Metal MTG. Plate		Sangamo	PLT-4520	
C37	Same as C3				
C38	CAPACITOR, .003 mfd, Mica ±2% 500VDCW		Sangamo	C-1230	
C39	Same as C38				
C40	Same as C24				
C41	Same as C10				
C42	CAPACITOR, Temperature Compensating		Sierra	SU-1039-1	
C43	Same as C2				
C44	Same as C2				
C45	Same as C2				
D1	DIODE, Germanium	2nd DET	Sylvania	1N34	
F1	FUSE, Type 3AG-2 Ampere		Littelfuse	312002	

REPLACEABLE PARTS LIST

Schem. Ref. No.	Description	Use	Mfr.	Dwg. or Mfr. No.	Tot. Quan.
I1	INDICATING LAMP, 6-8 Volt-Bayonet Base-Bulb T 3-1/4		National Union	N47	
J1	PHONE JACK		Switch Craft	12-A Littlejax	
L1	INDUCTANCE, 2.5 Millihenrys	Xtl.Osc.		SS-3425-2-2	
L2	Not Used				
L3	INDUCTANCE, Variable	Inj. Osc.		SS-3399-1	
L4	INDUCTANCE, Variable	Var. Osc		SS-800-1	
L5	REACTOR	Power Filter		SS-427-1	
L6	Same as L1				
L7	Same as L1				
L8	INDUCTANCE, 100 Millihenrys			SS-3425-2-3	
L9	INDUCTANCE, 150 Millihenrys			SS-3425-2-4	
M1	METER, 200 Microamperes, 400 ohms with Special Scale, +2 to -25 db		Weston or Burlington	Model 801 Model 741	
R1	RESISTOR, 4,700 ohms 1/2 Watt ±10%				
R2	POTENTIOMETER, 250,000 ohms			SS-393-2 Part 9	
R3	Not Used				
R4	RESISTOR, 22,000 ohms 1/2 Watt ±10%				
R5	RESISTOR, 12,000 ohms 2 Watt ±5%				
R6	RESISTOR, 10,000 ohms 1/2 Watt ±10%				
R7	RESISTOR, 100 ohms 1/2 Watt ±10%				
R8	RESISTOR, 220,000 ohms 1/2 Watt ±10%				
R9	RESISTOR, 2,200 ohms 1/2 Watt ±10%				
R10	RESISTOR, 1,500 ohms 1/2 Watt ±10%				
R11	POTENTIOMETER, 5,000 ohms			SS-393-2 Part 10	
R12	RESISTOR, 120,000 ohms 1/2 Watt ±10%				
R13	RESISTOR, 100,000 ohms 1/2 Watt ±10%				
R14	Same as R6				
R15	RESISTOR, 56,000 ohms 1/2 Watt ±10%				
R16	RESISTOR, 27,000 ohms 1 Watt ±5%				
R17	Same as R6				
R18	Same as R13				
R19	Same as R10				
R20	Same as R13				
R21	Same as R6				
R22	Same as R6				
R23	RESISTOR, 47,000 ohms 1/2 Watt ±5%				
R24	RESISTOR, 150,000 ohms 1/2 Watt ±10%				
R25	POTENTIOMETER, 1 Megohm (with Power Switch)			SS-393-2 Part 11	
R26	Same as R9				
R27	Same as R13				
R28	Same as R13				
R29	Same as R13				
R30	Same as R10				
R31	RESISTOR, 1 Megohm 1/2 Watt ±10%				
R32	RESISTOR, 150 ohms 1/2 Watt ±10%				

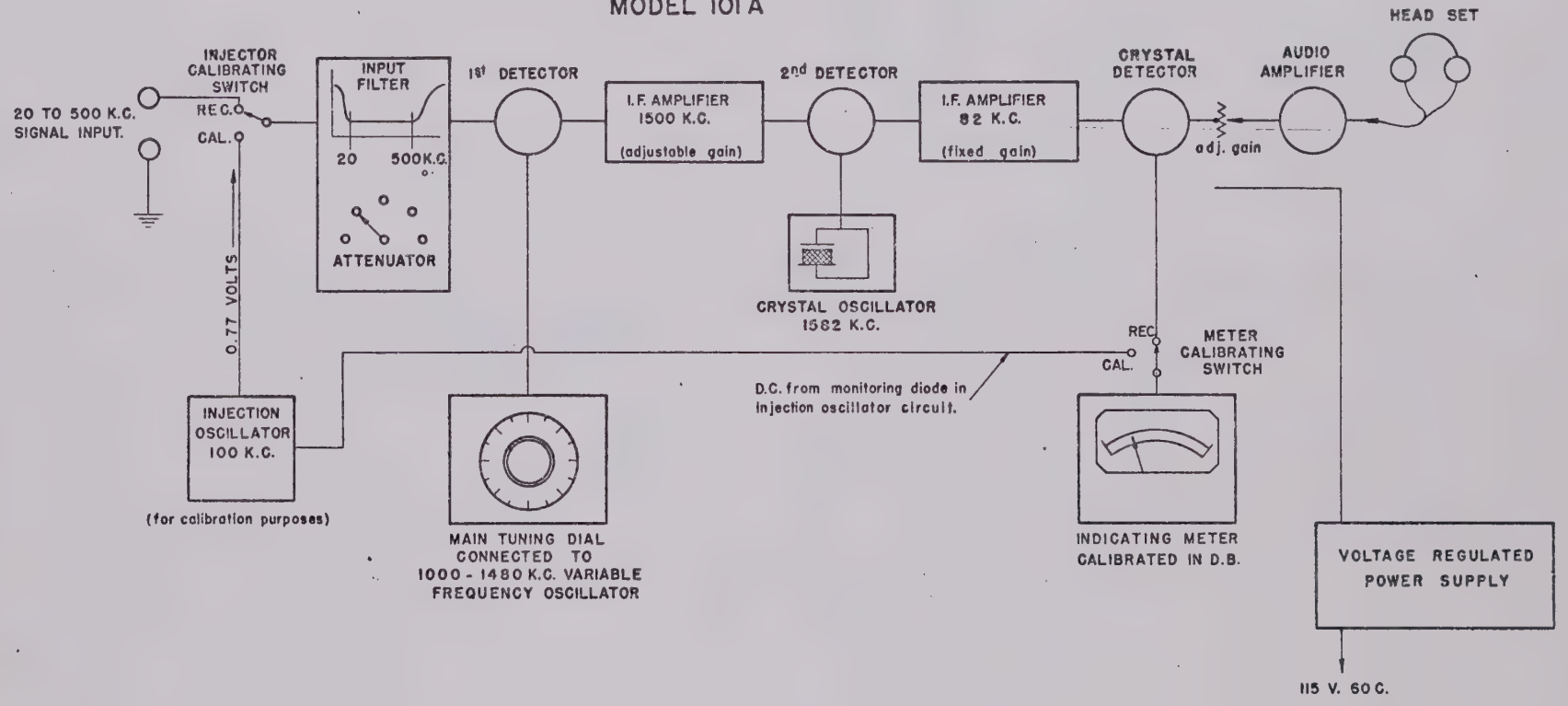
REPLACEABLE PARTS LIST

Schem. Ref. No.	Description	Use	Mfr.	Dwg. or Mfr. No.	Tot. Quan.
R33	RESISTOR, 39,000 ohms 1/2 Watt ±10%				
R34	RESISTOR, 1,000 ohms 1/2 Watt ±10%				
R35	Same as R15				
R36	Same as R34				
R37	RESISTOR, 25,000 ohms 10 Watt Wire Wound(Fixed) Wire Leads				
R38	Same as R9				
R39	Same as R31				
R40	Same as R23				
R41	Same as R33				
R42	POTENTIOMETER, 2,500 ohms			SS-393-2 Part 12	
R43	Not Used				
R44	Not Used				
R45	Not Used				
R46	RESISTOR, Nonreactive, 1/2 Watt Carbon, 3950 Ohms ±1%	Attenuator		E-3277-1	
R47	RESISTOR, Nonreactive, 1/2 Watt Carbon, 1081 Ohms ±1%	Attenuator		E-3277-1	
R48	RESISTOR, Nonreactive, 1/2 Watt Carbon, 341.9 Ohms ±1%	Attenuator		E-3277-1	
R49	RESISTOR, Nonreactive, 1/2 Watt Carbon, 108.1 Ohms ±1%	Attenuator		E-3277-1	
R50	RESISTOR, Nonreactive, 1/2 Watt Wire Wound 34.19 Ohms ±1%	Attenuator	HP	SS-1010-1	
R51	RESISTOR, Nonreactive, 1/2 Watt Wire Wound 10.81 Ohms ±1%	Attenuator		E-3277-1	
R52	RESISTOR, Nonreactive, 1/2 Watt Wire Wound 3.419 Ohms ±1%	Attenuator	HP	SS-1010-1	
R53	RESISTOR, Nonreactive, 1/2 Watt Wire Wound 1.581 Ohms ±1%	Attenuator	HP	SS-1010-1	
R54	RESISTOR, Nonreactive, 1/2 Watt Carbon, 7110 Ohms ±1%	Attenuator		E-3277-1	
R55	RESISTOR, Nonreactive, 1/2 Watt Carbon, 9,625 Ohms ±1%	Attenuator		E-3277-1	
R56	Same as R55				
R57	RESISTOR, Nonreactive, 1/2 Watt Carbon, 24,750 Ohms ±1%	Attenuator		E-3277-1	
R58	RESISTOR, Nonreactive, 1/2 Watt Carbon, 6,110 Ohms ±1%	Attenuator		E-3277-1	
R59	Same as R58				
R60	RESISTOR, Nonreactive, 1/2 Watt Carbon, 79,000 Ohms ±1%	Attenuator		E-3277-1	
R61	RESISTOR, Nonreactive, 1/2 Watt Carbon, 5,325 Ohms ±1%	Attenuator		E-3277-1	
R62	Same as R61				
SW1	TOGGLE SWITCH, D.P.D.T. Bathandle-3A-125V Sleeve 1/2" Long Solder Terminals		A-H & H	Type 20905	
SW2	Same as SW1				
SW3	Not Used				
SW4	ROTARY SWITCH, 11 Positions, 3 Decks	Attenuator		SS-460-1	
T1	IF TRANSFORMER	1500 kc IF	Miller	912-W2	
T2	Same as T1				

REPLACEABLE PARTS LIST

Schem. Ref. No.	Description	Use	Mfr.	Dwg. or Mfr. No.	Tot. Quan.
T3	Same as T1				
T4	IF TRANSFORMER	82 kc IF		SS-802-1	
T5	IF TRANSFORMER	82 kc IF		SS-1049-1	
T6	TRANSFORMER, Plate-Filament	Power Supply		SS-428-1	
V1	VACUUM TUBE			6SB7Y	
V2	VACUUM TUBE			6SJ7	
V3	Same as V1				
V4	Same as V2				
V5	Not Used				
V6	VACUUM TUBE			6SN7-GT	
V7	VACUUM TUBE			6SQ7	
V8	Same as V6				
V9	VACUUM TUBE			5Y3-G	
V10	VACUUM TUBE			6Y6-G	
V11	Same as V2				
V12	VACUUM TUBE			OB-2	
XF1	FUSE HOLDER, 3AG Finger Fuse Extractor Post, Miniture		Littlefuse	342003	
XL1	LAMP SOCKET with Removable 1/2 Inch Jewel: Horizontal Mounting-Open Type		E.F. Johnson	147-403 Faceted Jewel	
XTAL	QUARTZ CRYSTAL, 1582 kc Complete with socket			SS-789-1	
	COUPLING, Slide Action, Flexible, Steatite				
	GEAR DRIVE SET, With Dial (Less TX-9 Coupling)		National	NPW-0	
	INSULATION, 1/4" Shaft		Millen	39006	
	KNOB, Black, 1-1/8" Diam. 5/8" High		Bud	K-154	
	KNOB, Black, 1-1/8" Diam. 5/8" High		Bud	K-154	
	KNOB, Black, 2-1/16" Diam. 7/8" High		Bud	K-157	
	LINE CORD, 7 Foot Type 18/2 SJ with Moulded Rubber Cap, Separate Ends 2 Inches and Tin 1/2 Inch		R.H. Fisher		
	STAND-OFF INSULATOR	C-42	National	GS-10	
	STAND-OFF INSULATOR	L-9	National	GS-10	
	TUBE SOCKET, 7 Pin Miniature		Cinch	7EB	
	TUBE SOCKET, 8 Pin		Cinch	8A8	
	TUBE SHIELD, 2-3/4" Long for GT Tube	V6	I.C.A.	1729B	
	TUBE SHIELD, 2-3/4" Long for GT Tube	V8	I.C.A.	1729B	

CARRIER FREQUENCY VOLTMETER
MODEL 101 A

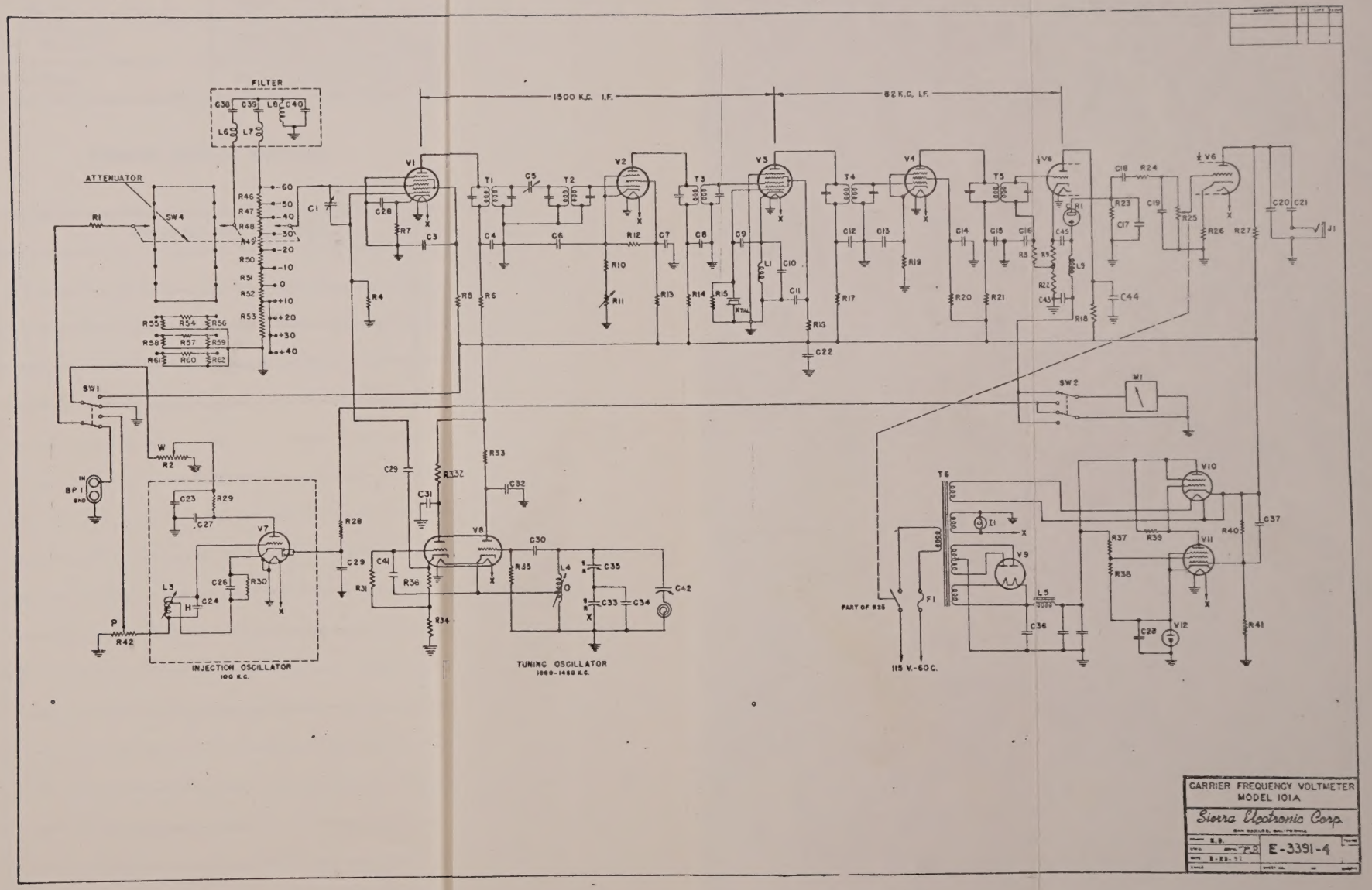


BLOCK DIAGRAM

SIERRA ELECTRONIC CORPORATION

SAN CARLOS, CALIFORNIA.

DATE: 1-12-48 DWG. NO. SP-3533-2


FILTER
C38 C39 L6 C40
L6 L7
1500 K.C. I.F.
82 K.C. I.F.
ATTENUATOR
SW4
R1
R46 R47 R48 R49 R50 R51 R52 R53
-60 -50 -40 -30 -20 -10 0 +10 +20 +30 +40
R55 R54 R56
R58 R57 R59
R61 R60 R62
C1
V1
V2
V3
V4
½V6
½V6
½V6
T1 T2 T3 T4 T5
C5
C4 C6
C28 R7 C3
R12 R10 R11
C7 C8 C9
R13 R14 R15
XTAL
L1 C10 C11
C12 C13
R17 R19
C14 C15 C16 C45
R20 R21
R8 R9 R22 C43 L9
R18 C44
C18 R24 R23 C17
C19 R25 R26 R27
C20 C21 J1
R4
R5 R6
C22
SW1
SW2
M1
W
R2
IN
BP 1
GND
C23 R29
C27
V7
C26 R30
C24
L3
H
P
R42
R28
C29
R31
C41
R36
C29
R33Z
R33
C31
C32
V8
C30
R35
L4
C35
C33 C34
C42
INJECTION OSCILLATOR
100 K.C.
TUNING OSCILLATOR
1000-1480 K.C.
T6
V10
I1
V9
V11
R37 R39
R38
C37
R40
L5
C36
C28
V12
R41
PART OF R28
F1
115 V.-60 C.
CARRIER FREQUENCY VOLTMETER
MODEL 101A
Sierra Electronic Corp.
SAN CARLOS, CALIFORNIA
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CHANGE NOTICE SUMMARY

Revision	Reason for Change	Date of Change

62685